Evolution of new hardware technology

OVERVIEW

Evolution of new hardware computer technology continues at a rapid pace. Implications of developments in semiconductor LSI technology for logic and memories, new achievements in magnetic bubbles and disk storage and progress in computer printer technology for a modern computer system are far reaching. The impact of these developments has resulted in (i) significant cost reduction for a given function; (ii) increased complexity resulting in enhanced capability and performance; (iii) improved reliability; and, (iv) reduction in physical size. These trends can be expected to continue during the next decade and even though these technological changes are evolutionary, their impact on the computer organization and utilization is indeed revolutionary. Entire new areas of application will become available to the computer industry with the advent of inexpensive yet powerful and versatile hardware. The generic impact on the architecture and configuration of a computer will be as follows:

- Every type of terminal, control and data entry equipment, etc., will have a rather large amount of intelligence at the point of use.
- Dedicated small digital systems will be incorporated in computer subsystems, i.e., computer peripherals.
- System design will be determined by repetitive use of very inexpensive hardware.
- Archival mass storage will be available on line.
- Today’s operating system features and other system software will be implemented in firmware.
- Performance measurement monitoring, maintenance and error logging accompanied with fail soft and fault tolerant design will be incorporated for increased hardware reliability and availability.

The three key areas of technical progress responsible for the developments projected above are: (1) semiconductor technology for LSI logic, microprocessors and RAMs/ROMs; (2) magnetic technology for bubble memories, and disk storage; and, (3) printer technology for data/information output. Present status and
projected developments in these areas will be described in the sessions on hardware evolution.

Semiconductor technology has been able to double the functional density on a single silicon chip every year since 1960. In the logic area, this progress has taken this technology from a single transistor to IC's and then to microprocessors and microcomputers. In complexity the microprocessors have evolved through 4 bit and 8 bit complexity to 16 bit complexity. By incorporating ever increasing RAM/ROM and control function powerful single chip microcomputers have become available for a price of about $10. Progress in the technology promises that by about the mid-eighties a 32 bit microcomputer with one million bits of memory could be made on a single silicon chip for a cost of about $20. With such inexpensive but powerful intelligence, no equipment would be permitted to stay dumb anymore.

In the area of semiconductor memory, the first challenge to the dominance of magnetic core memories occurred in 1970 when the first 1K bit semiconductor memories became available. Since then the progress in this area has been rapid and now the technology stands on the threshold of the availability of 64K bit RAMs. This progression in complexity is likely to continue and reach a 1 million bits per chip by 1985.

CCD and magnetic bubble technologies provide solid state alternatives to rotating electromechanical mass storage devices. During the past year, significant technical advances have taken place in both of these areas. Both of these technologies have started to appear in the commercial products. CCD memories have faster access times than the bubble memories and will find a place in the memory hierarchy. Bubble memories, however, promise to reach the 1 million bit on a chip capability sooner than any semiconductor technology. The resulting low cost and high reliability when coupled with their inherent characteristics of non-volatility will permit this technology to fill the presently existing gap between semiconductor memories and moving magnetic mass storage.

Even as the CCD and bubble memories become more cost effective and attempt to replace magnetic disk technology, the moving head disk technology continues to improve. Disk technology progress has included not only the readwrite heads but media, source coding and error correction and improved system bus interfacing. These developments have improved the performance and reliability. Area density of storage has continuously increased and has been a key factor in achieving cost reductions.

Printer technology developments is another area of major activity. Both the impact and non-impact printing technologies using plain paper have progressed significantly. Ink Jet and xerographic printers are now commercially available. Progress in these technologies is radically changing the quality of the computer output as well as the cost of computer printing.

The technical developments in the areas discussed above will be described and projection of developments in the years to come will be made by experts who themselves have played a major role in making these developments possible.

One more aspect of this rapid evolution in hardware technologies is that wherever there is a significant technological change, there are opportunities for entrepreneur organizations to bring these technologies to the marketplace. A panel of distinguished speakers will address themselves to the proposition of "Opportunities for New High Technology Companies" as a part of the series of sessions on Evolution of New Hardware Technology."